

# The Abrupt Expansion of Ambulatory Telemedicine: Implications for Patient Safety



Elaine C Khoong, MD, MS<sup>1,2</sup>, Anjana E Sharma, MD, MAS<sup>2,3</sup>, Kiran Gupta, MD, MPH<sup>4</sup>, Julia Adler-Milstein, PhD<sup>5,6</sup>, and Urmimala Sarkar, MD, MPH<sup>1,2</sup> 

<sup>1</sup>Division of General Internal Medicine at Zuckerberg San Francisco General Hospital, Department of Medicine, University of California San Francisco, San Francisco, CA, USA; <sup>2</sup>UCSF Center for Vulnerable Populations at Zuckerberg San Francisco General Hospital, San Francisco, USA; <sup>3</sup>Department of Family and Community Medicine, University of California San Francisco, San Francisco, USA; <sup>4</sup>Division of Hospital Medicine, Department of Medicine, University of California San Francisco, San Francisco, USA; <sup>5</sup>Center for Clinical Informatics and Improvement Research (CLIR) at University of California San Francisco, San Francisco, USA; <sup>6</sup>Department of Medicine, University of California San Francisco, San Francisco, USA.

The exponential growth of telemedicine in ambulatory care triggered by the COVID-19 public health emergency has undoubtedly impacted the quality of care and patient safety. In particular, the increased adoption of remote care has impacted communication, care teams, and patient engagement, which are key factors that impact patient safety in ambulatory care. In this perspective, we draw on a scoping review of the literature, our own clinical experiences, and conversations with patient safety experts to describe how changes in communication, care teams, and patient engagement have impacted two high priority areas in ambulatory safety: diagnostic errors and medication safety. We then provide recommendations for research funders, researchers, healthcare systems, policy makers, and healthcare payors for how to improve patient safety in telemedicine based on what is currently known as well as next steps for how to advance understanding of the safety implications of telemedicine utilization.

**KEY WORDS:** Ambulatory care; Patient safety; Telemedicine; Diagnostic errors; Medication errors.

J Gen Intern Med 37(5):1270–4

DOI: 10.1007/s11606-021-07329-9

© The Author(s) under exclusive licence to Society of General Internal Medicine 2022

COVID-19 spurred significant growth in telemedicine use in American ambulatory healthcare. Previously, telemedicine (which we define as synchronous, scheduled video or telephone visits between clinicians and patients) had been limited primarily to specific clinical scenarios (e.g., specialty consultations in rural areas, low acuity concerns) or large health systems. The pandemic expanded telemedicine to additional contexts and populations. Moving forward, telemedicine use will remain more prevalent compared to pre-pandemic. This rapid shift requires attention to unintended

consequences. Chief among these is the implications for patient safety, particularly in low-income populations and communities of color who are disproportionately cared for by under-resourced systems that may have adopted telemedicine rapidly but incompletely thereby increasing the potential for safety vulnerabilities. By identifying factors that heighten safety risk in telemedicine care, we can mitigate them. In this paper, we focus on the safety risks of telemedicine only and do not include consideration of other telehealth modalities (e.g., remote patient monitoring, secure messaging).

Ambulatory patient safety incidents are frequent, with an estimated 2–3 adverse events in every 100 primary care visits.<sup>1</sup> In an AHRQ (Agency for Healthcare Research and Quality)-commissioned technical brief on ambulatory safety, key informants identified six *domains of ambulatory safety* (medication management, diagnostic errors, care transitions, referrals, culture, and testing) and six *strategies used to address these vulnerabilities* (communication, health technology, teams, patient engagement, organizational approaches, and measurement).<sup>2</sup> We use this framework to identify the strategies most altered by telemedicine and how those changes impact specific ambulatory safety domains.

## HOW TELEMEDICINE IMPACTS AMBULATORY PATIENT SAFETY: CHANGES IN COMMUNICATION, CARE TEAMS, AND PATIENT ENGAGEMENT

To some extent, telemedicine impacts all six strategies, but in comparison to in-person care, telemedicine care delivery most dramatically alters communication, care teams, and patient engagement. Communication is the cornerstone of safe care.<sup>3</sup> Telemedicine amplifies communication challenges between patients and providers due to loss of nonverbal cues from patients and clinicians as well as discomfort raising sensitive topics. These issues are even further exacerbated in audio-only encounters, which account for >90% of telemedicine encounters in safety-net systems.<sup>4</sup>

When healthcare teams are not co-located, clinical teams must rely on less rich communication modalities, such as

Received June 14, 2021

Accepted December 14, 2021

Published online January 19, 2022

written communication, which is more likely to result in miscommunication in comparison to verbal handoffs.<sup>5</sup> The reduction in team-based care also increases the cognitive load on clinicians as they take on more work during the same amount of encounter time.<sup>6</sup> Even if clinical teams return to work in-person, these issues could persist if clinicians deliver telemedicine care “from the office.” Unfortunately, there is limited experience with how to optimally design care teams around models that feature high use of telemedicine.<sup>7</sup>

Care delivered through telemedicine is more reliant on patient engagement. At a basic level, patients need to use digital tools to attend the telemedicine visit. In addition, telemedicine relies more heavily on patients monitoring their health through home devices, such as blood pressure monitors. Due to a limited physical exam, clinical decision-making in telemedicine visits often relies on patient self-monitoring and patient ability to accurately identify and describe changes in symptoms. Since the patient is not on-site, clinicians also rely on patients to follow through with diagnostic tests, such as blood draws or imaging, in a timely fashion.

While these three areas, and the changes described within them, impact all patient safety domains, two domains are disproportionately impacted—diagnostic errors and medication safety, and these domains have high preexisting levels of ambulatory safety concerns.<sup>8, 9</sup> Below we describe how the changes outlined above may increase concerns in these two domains, drawing on our clinical experiences, conversations with patient safety experts, and a review of the telemedicine and patient safety literature (Table 1).

**Table 1 Domains of Potential Ambulatory Safety Concerns from Telemedicine**

Dimensions of patient safety	Mechanisms through which telemedicine could worsen patient safety
Diagnostic errors	<ul style="list-style-type: none"> <li>- Inadequate or lower quality history or physical exam (especially with audio-only encounters or other factors that reduce communication quality)</li> <li>- Reliance on patients to collect key data (vital signs, description of physical findings)</li> <li>- Increased cognitive load on clinician from reduction in team-based care</li> </ul>
Medication safety	<ul style="list-style-type: none"> <li>- Changes in behaviors for diagnostic work-up</li> <li>- Patient-provider communication challenges may impede high-quality medication reconciliation, which is an evidence-based approach to prevent adverse drug events</li> <li>- Lack of access to other team members to conduct more in-depth medication reconciliation (e.g., pharmacist)</li> <li>- Increased reliance on patients’ literacy, language skills, or technology skills to conduct medication reconciliation</li> <li>- Change in availability of tools that can be used to ensure shared understanding of medication regimens (e.g., after visit summaries)</li> </ul>

**POTENTIAL IMPACT ON DIAGNOSTIC ERRORS**

Achieving a timely, accurate diagnosis in ambulatory care is a significant safety challenge.<sup>10</sup> In a recent study, clinicians expressed concern about diagnostic safety in telemedicine encounters.<sup>11</sup> This largely results from a reduced ability to collect information to formulate an accurate diagnosis.

Specifically, most telemedicine encounters have limited objective information including vital signs and physical exam findings. Although a patient may have remote medical devices (e.g., blood pressure monitor) and the clinician can visualize some physical exam concerns, the clinician is not able to conduct a full physical exam. Clinicians also do not have access to other diagnostic tools (e.g., stethoscopes, reflex hammers) and may be unable to perform specific diagnostic maneuvers. Contextual information such as the patient’s gait, the effort involved rising from a chair, or the ability to see a patient’s entire body is lost without explicitly instructing a patient to perform these tasks. These challenges are exacerbated in audio-only encounters that lack all visual diagnostic clues. Importantly, few clinicians have received training on how to perform clinical assessments during telemedicine encounters, and best practices are still under development. As best practices are developed, clinicians may express fewer concerns about being unable to conduct a traditional physical exam.

Another concern is whether telemedicine impacts a clinician’s likelihood of ordering a diagnostic test. It is unclear if telemedicine results in clinicians being less likely to order a diagnostic test (since a patient is not physically present) or more likely to order a diagnostic test (since the clinician has less clarity on the diagnosis). Moreover, if clinicians are experiencing increased cognitive load from having less support from their clinical team, clinicians may be more prone to over-testing and its resulting negative impacts on patient care and outcomes.

It is therefore surprising that early literature suggests that overall diagnostic accuracy is not impacted during telemedicine encounters.<sup>12</sup> However, the importance of missing vital signs or physical exams likely depends on the clinical concern. Abdominal pain is difficult to assess remotely because it requires a physical exam to appropriately triage the concern, but an elevated blood pressure can often be triaged with an accurate blood pressure measurement. Further, it is concerning that diagnostic errors comprise most telemedicine-related malpractice lawsuits.<sup>13</sup>

**POTENTIAL IMPACT ON MEDICATION SAFETY**

Ambulatory medication safety concerns include high levels of adverse drug events (ADEs) with one study estimating that ~25% of new prescriptions in primary care encounters resulted in an ADE.<sup>8</sup> While ADEs can include serious outcomes, such as life-threatening drug reactions, many are preventable or

easily ameliorable if clinicians responded to medication-related symptoms.<sup>8</sup>

A high-quality medication reconciliation reduces the risks of ADEs and facilitates safe medication management.<sup>14</sup> However, conducting a quality medication reconciliation is challenging, and telemedicine poses unique challenges. Studies have shown that non-physician team members conduct higher quality medication reconciliation;<sup>15</sup> if pharmacists or other team members are not incorporated into telemedicine encounters, clinician understanding of how patients are taking their medications is likely reduced. Moreover, remote medication reconciliation (particularly in audio-only encounters) relies on a patient's ability to read a medication name. This is particularly challenging for patients with limited health literacy or limited English proficiency, who already experience greater medication misunderstandings during in-person medication reconciliation processes.<sup>16</sup>

Clinician communication of recommended medication changes is also impacted by telemedicine. Visual cues and written education are often used to improve understanding, particularly for complex medication regimens. These tools are

more limited in telemedicine interactions, especially during audio-only encounters. While screen sharing or provision of educational materials through patient portals may address some challenges, these tools are not accessible to all patients. Early literature in a young population with simple medication regimens suggests that medication changes in telemedicine encounters are equally safe to in-person care, but this finding may not be applicable to the broader population.<sup>17</sup>

## ADVANCING AMBULATORY PATIENT SAFETY IN TELEMEDICINE

Given potential risks related to diagnostic and medication safety, it is critical to move from our anecdotal understanding of safety to a robust evidence base. We advise the following steps (Table 2).

1. Systematically measure patient safety outcomes and increase reporting of safety incidents, with a focus on those most likely increased by telemedicine

**Table 2 Steps to Advance Understanding of Telemedicine Impact on Patient Safety**

Key recommendations	Recommendations for each stakeholder
Systematically measure patient safety outcomes and increase reporting of safety incidents, with a focus on those most likely increased by telemedicine	<p><b>Researchers</b></p> <ul style="list-style-type: none"> <li>- Explicitly include safety outcomes, particularly those identified in existing ambulatory patient safety literature</li> <li>- Include easily measured outcomes extracted from the electronic health record</li> </ul> <p><b>Healthcare systems</b></p> <ul style="list-style-type: none"> <li>- Improve infrastructure to ease clinician use and access to incident reporting systems</li> <li>- Increase patient engagement in safety evaluations by:               <ul style="list-style-type: none"> <li>- Increasing opportunities for patients to report safety incidents</li> <li>- Including patients in quality and safety committees</li> </ul> </li> </ul>
Identify the patients and clinical scenarios with the greatest risk of unsafe telemedicine care	<p><b>Researchers</b></p> <ul style="list-style-type: none"> <li>- Identify patient characteristics that may increase risk for safety incidents</li> <li>- Evaluate clinical scenarios when telemedicine can facilitate safer care, including variations in chief complaints, visit purpose, clinician specialty, or type of telemedicine</li> <li>- Focus on comparative effectiveness evaluations (e.g., is in-person care an appropriate comparison?)</li> </ul> <p><b>Healthcare systems</b></p> <ul style="list-style-type: none"> <li>- Disseminate and describe telemedicine implementation strategies to facilitate research that explores the issues above</li> <li>- Partner with evaluators to ensure rigorous, real-world evaluations</li> </ul>
Identify and support best practices* to ensure equal access to safe telemedicine care	<p><b>Research funders</b> (identify best practices)</p> <ul style="list-style-type: none"> <li>- Fund evidence generation to identify best practices</li> </ul> <p><b>Healthcare systems</b> (support best practices)</p> <ul style="list-style-type: none"> <li>- Proactively support audio-visual encounters for as many patients as possible</li> <li>- Develop strategies to support patients that may have challenges accessing video telemedicine encounters, such as older patients or patients with language barriers or limited digital literacy<sup>21</sup></li> </ul> <p><b>Policy makers</b> (support best practices)</p> <ul style="list-style-type: none"> <li>- Increase funding for programs that improve digital infrastructure (broadband) and digital access (low-cost broadband and devices)</li> </ul> <p><b>Healthcare payors</b> (support best practices)</p> <ul style="list-style-type: none"> <li>- Provide reimbursement to support all patients in accessing telemedicine care</li> <li>- Recognize additional resources are needed by clinicians that serve patients with challenges accessing telemedicine</li> <li>- Reimburse for remote monitoring tools and home diagnostic procedures</li> </ul>

\*These recommendations are focused on video-based telemedicine and access to remote clinical data as best practices and meant to illustrate how best practices should be supported by multiple stakeholders

Researchers must explicitly include safety outcomes drawn from the safety literature<sup>18</sup> in telemedicine evaluations. Focusing on measures easily captured in electronic health records (EHR) rather than on chart reviews may facilitate earlier understanding of the breadth and depth of patient safety concerns. EHR measures for diagnostic safety include emergency department presentations or hospital admissions shortly after a telemedicine encounter.<sup>18</sup> Medication safety can be measured by assessing inappropriate concurrent use of medications with similar risks, such as warfarin and non-steroidal anti-inflammatory drugs, or hospital admissions for adverse drug events.

To increase clinician utilization of incident reporting systems, healthcare systems should incentivize clinicians to report incidents related to telemedicine encounters and consider integrating reporting systems into EHRs, such as by linking to an external reporting system within the EHR or automating completion of basic clinical information in the incident report.<sup>19</sup> Any integration effort should carefully consider the tradeoffs between reducing barriers to incident reporting and potential inclusion of unverified assertions in the legal medical record. Given the importance of patient self-assessment in telemedicine and prior literature showing that patients identify different safety incidents than healthcare teams,<sup>20</sup> healthcare systems should expand opportunities for patients to report safety incidents and include patients in quality and safety committees.

## 2. Identify the patients and clinical scenarios with the greatest risk of unsafe telemedicine care

Communication and safety challenges are likely exacerbated in certain populations (e.g., older adults, visual/hearing impaired) and clinical scenarios (e.g., follow-up of chronic disease vs acute concern). Similarly, the potential benefits of telemedicine relative to in-person care may be greater for populations with barriers accessing in-person care (e.g., transportation challenges). To create actionable evidence, researchers need to assess the impact of telemedicine on safety outcomes in these specific populations. Evaluations should therefore not simply compare telemedicine versus in-person care. Instead, evaluators should acknowledge the variations in how and when telemedicine is used rather than making broad conclusions about telemedicine safety regardless of chief complaint, type of patient, purpose of use, or mode of telemedicine delivery. In turn, this understanding can guide health systems and clinicians in designing processes that determine when a telemedicine option should be offered.

To help facilitate evaluations, healthcare systems should delineate how and when they use telemedicine care. With more widespread use, telemedicine operations and workflows will change. Health systems should document changes they make and the rationale behind these changes, so that a real-world understanding emerges of how to employ telemedicine safely and optimally. Importantly, they should partner with researchers to conduct health system embedded research to accelerate understanding of these issues.

## 3. Identify and support best practices to ensure equal access to safe telemedicine care

Given the limited literature on telemedicine ambulatory safety, the most important steps are those listed above: measuring safety outcomes and understanding for which patients in which situations safety may be compromised. These efforts will facilitate identification of best practices, but this evidence generation is not possible without support from funding agencies. When best practices are identified, healthcare systems and payors should support clinicians in adopting best practices. Although there is limited knowledge about best practices, we believe it is reasonable to start advocating for broader access to video-based telemedicine encounters and remotely collected clinical data. We will use these two examples to illustrate how multi-level stakeholders can support clinicians to engage in best practices.

We know that communication is central to safety, and communication is better with access to the nonverbal, visual cues available in video-based telemedicine. Although there is no definitive evidence on the safety of audio-only versus audio-visual telemedicine encounters, we believe it is crucial to improve access to video-based telemedicine to foster safer communication. Policymakers and payors need to address patient- and healthcare system-related barriers<sup>21</sup> to audio-visual encounters. This includes expanding programs, such as the Lifeline program, that reduce the cost of acquiring devices for low-income populations; incentivizing development of broadband access in rural and low-income urban areas; and providing reimbursement for time spent supporting patients in accessing telemedicine care. Similarly, while health systems should not eliminate audio-only encounters for those patients who cannot access video-based services, health systems should support patients in accessing video-based care, recognizing that some patients (e.g., older, limited digital literacy, language barriers) may require substantial support.

Similarly, access to key objective data (such as vital signs) will address some concerns about the safety of telemedicine encounters. Healthcare payors should support acquisition of remote monitoring tools by providing reimbursement for devices that collect vital signs, including weight, blood pressure, or pulse. This is crucial for patients with financial challenges to securing their own devices. For patients who have challenges leaving the home, reimbursement for home diagnostic procedures (e.g., phlebotomy, electrocardiograms) will ensure safer (and more accessible) care.

## CONCLUSION

As telemedicine adoption grows, it is imperative that researchers expand evaluation of patient outcomes beyond feasibility and satisfaction to quality and safety. Studies should build on our growing understanding of the diversity in how, when, and to whom telemedicine is delivered as well as our increasing sophistication in measuring ambulatory safety. We

specifically advise that safety advocates and researchers focus on measuring safety implications in diagnosis and medication management, where telemedicine has had the biggest impact. Health systems can help facilitate evaluation by improving the infrastructure for and use of incident reporting mechanisms and leveraging EHR data. We can turn the current crisis into an opportunity to identify best practices to ensure that health systems deliver telemedicine that is safe, equitable, and of high quality.

**Corresponding Author:** Urmimala Sarkar, MD, MPH; Division of General Internal Medicine at Zuckerberg San Francisco General Hospital, Department of Medicine, University of California San Francisco, San Francisco, CA, USA (e-mail: [urmimala.sarkar@ucsf.edu](mailto:urmimala.sarkar@ucsf.edu)).

**Author Contribution** All authors contributed to the conception of the work and provided final approval of the version to be published. EK drafted the work and the remaining authors critically revised it for important intellectual content. Marika Dy and David Coleman assisted with a background literature review.

**Funding** Research reported in this publication was supported by the National Heart Lung and Blood Institute of the NIH under Award Number K12HL138046 and K23HL157750 (EK), the National Center for Advancing Translational Sciences of the NIH under Award Number KL2TR001870 (EK, AS), and the National Cancer Institute of the NIH under Award Number K24CA212294 (US). This project also received support from The Doctors Company. All content is solely the responsibility of the authors and do not necessarily represent the official views of the sponsors.

#### Declarations:

**Conflict of Interest:** JAM is on the Board of Directors and holds shares in Project Connect.

## REFERENCES

1. Singh H, Carayon P. A Roadmap to Advance Patient Safety in Ambulatory Care. *JAMA*. 2020;324(24):2481-2482. <https://doi.org/10.1001/jama.2020.18551>
2. Sarkar U, McDonald K, Motala A, et al. Pragmatic Insights on Patient Safety Priorities and Intervention Strategies in Ambulatory Settings. *Jt Comm J Qual Patient Saf*. 2017;43(12):661-670. <https://doi.org/10.1016/j.jcjq.2017.06.009>
3. Giardina TD, Royse KE, Khanna A, et al. Health Care Provider Factors Associated with Patient-Reported Adverse Events and Harm. *Jt Comm J Qual Patient Saf*. 2020;46(5):282-290. <https://doi.org/10.1016/j.jcjq.2020.02.004>
4. Uscher-Pines L, Sousa J, Jones M, et al. Telehealth use among safety-net organizations in California during the COVID-19 pandemic. *JAMA*. 2021;325(11):1106-1107. <https://doi.org/10.1001/jama.2021.0282>
5. Hess DR, Tokarczyk A, O'Malley M, Gavaghan S, Sullivan J, Schmidt U. The value of adding a verbal report to written handoffs on early readmission following prolonged respiratory failure. *Chest*. 2010;138(6):1475-1479. <https://doi.org/10.1378/chest.09-2140>
6. Harry E, Pierce RG, Kneeland P, Huang G, Stein J, Sweller J. Cognitive Load and Its Implications for Health Care. *NEJM Catal*. Published online March 14, 2018. <https://catalyst.nejm.org/doi/full/10.1056/CAT.18.0233>
7. Sinsky CA, Jerzak JT, Hopkins KD. Telemedicine and Team-Based Care: The Perils and the Promise. *Mayo Clin Proc*. 2021;96(2):429-437. <https://doi.org/10.1016/j.mayocp.2020.11.020>
8. Gandhi TK, Weingart SN, Borus J, et al. Adverse Drug Events in Ambulatory Care. *N Engl J Med*. 2003;348(16):1556-1564. <https://doi.org/10.1056/NEJMsa020703>
9. Singh H, Meyer AN, Thomas EJ. The frequency of diagnostic errors in outpatient care: estimations from three large observational studies involving US adult populations. *BMJ Qual Saf*. 2014;23(9):727-731. <https://doi.org/10.1136/bmjqs-2013-002627>
10. Committee on Diagnostic Error in Health Care, Board on Health Care Services, Institute of Medicine, The National Academies of Sciences, Engineering, and Medicine. Improving Diagnosis in Health Care. (Balogh E, Miller BT, Ball J, eds.). National Academies Press (US); 2015.
11. Sharma AE, Khoong EC, Nijagal M, et al. Clinician experience with telemedicine at a safety-net hospital network during COVID-19: a cross-sectional survey. *J Health Care Poor Underserved*. 2021;32(2):220-240. <https://doi.org/10.1353/hpu.2021.0060>
12. Izzo JA, Watson J, Bhat R, et al. Diagnostic accuracy of a rapid telemedicine encounter in the Emergency Department. *Am J Emerg Med*. 2018;36(11):2061-2063. <https://doi.org/10.1016/j.ajem.2018.08.022>
13. Feldman DL. How COVID-19 Accelerated Telemedicine Use. The Doctors Company. Published May 7, 2020. The Doctors Company. The Risks and Benefits of Telehealth in the Future of Healthcare. August 2020. [https://www.thedoctors.com/siteassets/pdfs/12482\\_telehealth\\_whitepaper\\_080420\\_f.pdf](https://www.thedoctors.com/siteassets/pdfs/12482_telehealth_whitepaper_080420_f.pdf). Accessed Jan 5 2021.
14. Kessler C, Ward MJ, McNaughton CD. Reducing Adverse Drug Events: The Need to Rethink Outpatient Prescribing. *JAMA*. 2016;316(20):2092. <https://doi.org/10.1001/jama.2016.16392>
15. Reeder TA, Mutnick A. Pharmacist- versus physician-obtained medication histories. *Am J Health-Syst Pharm AJHP QJ J Am Soc Health-Syst Pharm*. 2008;65(9):857-860. <https://doi.org/10.2146/ajhp070292>
16. Lyson HC, Sharma AE, Cherian R, et al. A Qualitative Analysis of Outpatient Medication Use in Community Settings: Observed Safety Vulnerabilities and Recommendations for Improved Patient Safety. *J Patient Saf*. Published online March 13, 2019. <https://doi.org/10.1097/PTS.0000000000000590>
17. Grossman D, Grindlay K. Safety of Medical Abortion Provided Through Telemedicine Compared With In Person. *Obstet Gynecol*. 2017;130(4):778-782. <https://doi.org/10.1097/AOG.0000000000002212>
18. Logan MS, Myers LC, Salmasian H, et al. Expert Consensus on Currently Accepted Measures of Harm. *J Patient Saf*. Published online August 5, 2020. <https://doi.org/10.1097/PTS.0000000000000754>
19. Haller G, Myles PS, Stoelwinder J, Langley M, Anderson H, McNeil J. Integrating Incident Reporting into an Electronic Patient Record System. *J Am Med Inform Assoc JAMIA*. 2007;14(2):175-181. <https://doi.org/10.1197/jamia.M2196>
20. Sharma AE, Rivadeneira NA, Barr-Walker J, Stern RJ, Johnson AK, Sarkar U. Patient Engagement In Health Care Safety: An Overview Of Mixed-Quality Evidence. *Health Aff Proj Hope*. 2018;37(11):1813-1820. <https://doi.org/10.1377/hlthaff.2018.0716>
21. Nouri S, Khoong EC, Lyles CR, Karliner L. Addressing equity in telemedicine for chronic disease management during the covid-19 pandemic. *NEJM Catal Innov Care Deliv*. Published online May 4, 2020. <https://catalyst.nejm.org>; <https://doi.org/10.1056/CAT.20.0123>

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.